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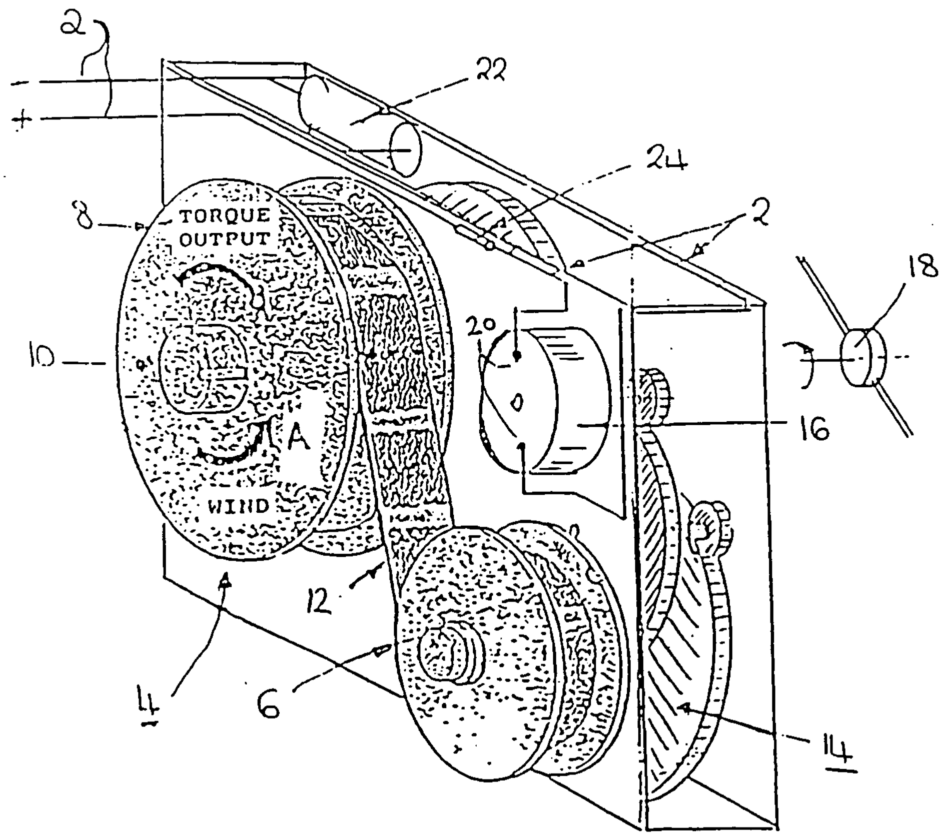
(54) Electrical generators

(57) An electrical generator for powering a radio comprises a spring motor (4) which is wound up by way of a key (18) such that the subsequent rotation of a torque drum (8) as a stressed spring (12) unwinds therefrom generates electrical power. The rotational speed of the drum (8) is geared up by gear means (14) and rotates the rotor of an electrical motor (16) to generate an output voltage. The output voltage is regulated by way of a Zener diode (24) and is fed to a radio by way of a jack plug. The simple wind up mechanism has been found to be able to power a radio for the order of one hour. The generator can also be used to charge batteries.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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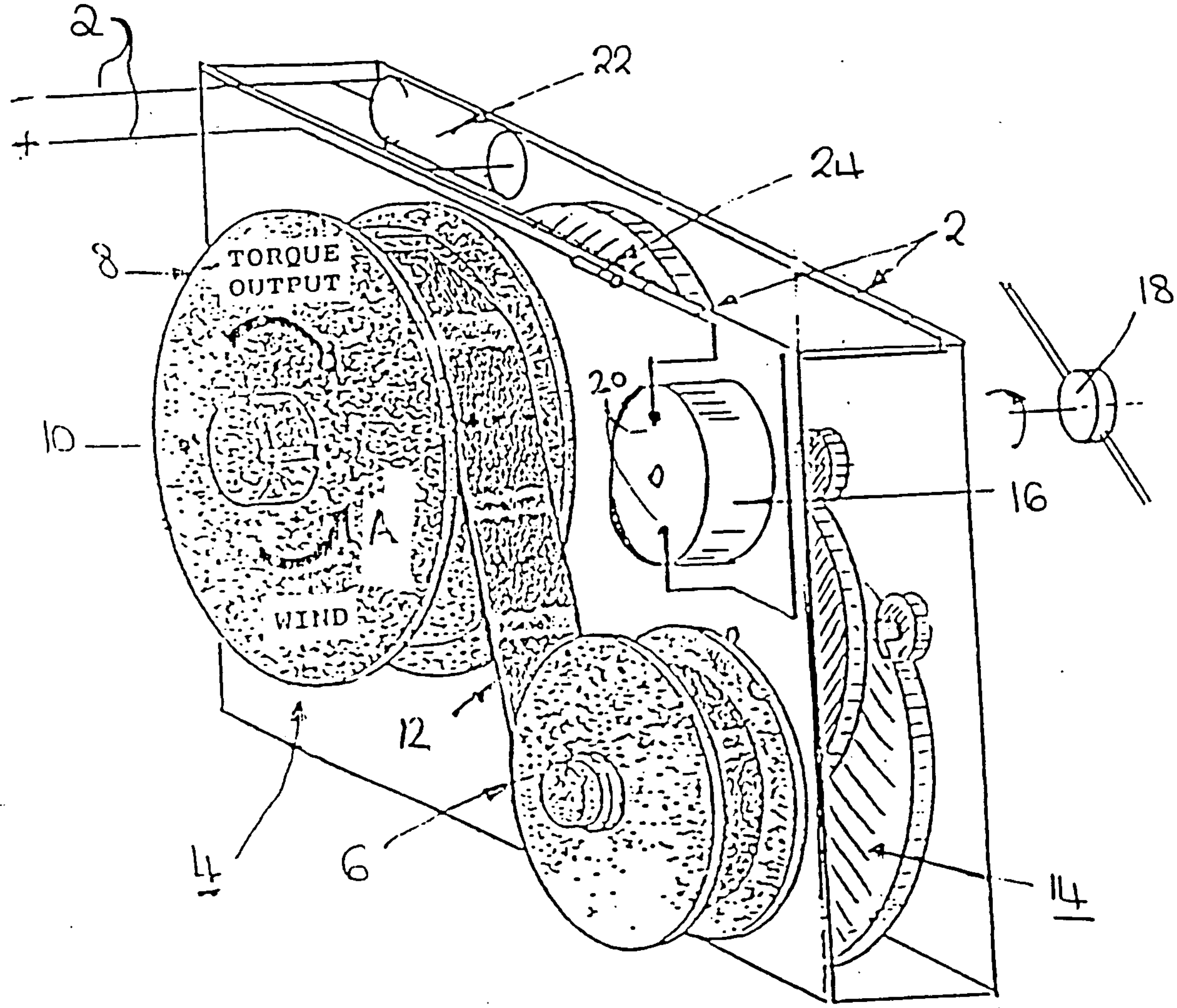

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4
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IMPROVEMENTS IN OR RELATING TO ELECTRICAL GENERATORS

The present invention relates to electrical generators, and to electrical devices powered by such generators.

In the Third World there are locations without mains electrical power. This means that any electrical devices, for example, such as radios, need to be battery operated. However, in such regions, batteries can be difficult to obtain, and more significantly, may be relatively expensive as compared to the resources of the people.

It is an object of the present invention to seek to make such electrical devices as may be available readily usable in such regions.

According to the present invention there is provided an electrical generator for powering an electrical device, said electrical generator comprising a spring motor having a metal band spring arranged to be stressed by being wound onto a rotatable torque drum and arranged to unwind from said drum to cause rotation thereof, an electrical motor having a rotor arranged to be rotated by the rotation of said torque drum and to thereby generate an electrical supply voltage at output terminals of said motor, gear means for coupling said torque drum to said rotor and arranged, upon the rotation of said drum, to rotate said rotor at a predetermined speed of rotation, and voltage regulator means electrically coupled to the output terminals of said motor such that the rotation of said torque drum causes a substantially constant voltage output.

An electrical generator of the invention may be used to power an electrical device, as a radio. As the power is generated mechanically from the spring motor no electrical

mains power is required for the operation of the device. Furthermore, the store of mechanical energy may be replenished by physical effort, that is, by rewinding the spring. There is no necessity to purchase batteries or other energy sources in order to keep the electrical device in working order.

Theoretically, the electrical device to be powered by the electrical generator may be any type of electrically powered device currently available. Preferably, however, the electrical device is portable and is one which is unlikely to require substantial electrical power levels. The electrical device may be, for example, a radio, a personal cassette player, a lamp, a games console, or a lap top computer.

In one embodiment, the electrical device comprises one or more batteries connected to be charged up by said electrical generator.

The spring motor may comprise a logarithmic spring or a spring conforming to Hookes' law. However, in a presently preferred embodiment, said spring motor has a metal band spring arranged to deliver a substantially constant force and thereby to cause said torque drum to rotate at a substantially constant speed of rotation.

For example, said metal band spring is a prestressed band of steel.

In a preferred embodiment, said spring motor comprises a freely rotatable, storage drum arranged such that the axes of said torque and storage drums extend substantially parallel, and wherein each end of the metal band spring is fastened to a respective one of the torque and storage drums such that the metal band spring may be wound from one

of the drums onto the other.

Such spring motors are already commercially available and are capable of rotating the torque drum at a slow, substantially constant, speed with good accuracy. The relative diameters of the torque and storage drums and the spacing of the axes of the drums may be adjusted to provide the rotational speed required. The width and thickness of the metal band spring may also be chosen as required.

In order to increase the capacity of the spring motor, more than one torque drum may be provided, all of the torque drums preferably being coupled to rotate a common torque output shaft. A common, or a series of, related storage drums are also preferably provided.

A wind up key may be provided and is arranged to rotate said torque drum or drums in a direction to wind the metal band spring(s) onto said torque drum(s). This mechanical wind up process stresses the spring(s) and thus stores mechanical potential energy. The potential energy is thereafter released by the unwinding of the spring(s) from the torque drum(s) and this causes rotation of the rotor which thereby generates electrical power.

If required, locking means may be provided to enable the spring motor to be locked in its condition storing potential energy. However, for most simple arrangements, this is not required. The electrical device is switched off when not required, and the spring motor is simply arranged to wind down. It is an easy matter to wind up the spring motor again when it is required to power the electrical device. However, it is generally preferred to provide appropriate protection mechanisms, such as appropriate stops, to prevent overwind or underwind of the spring.

Said electrical motor may be any type of electrical machine arranged to generate electricity in response to rotation of its rotor. For example, the rotor may be a permanent magnet rotor rotatable within a stator carrying one or more electrical coils. Alternatively, the rotor may carry the electrical coils, whilst the stator carries one or more permanent magnets. However the motor is constructed, it is preferred that it is arranged to be as compact and lightweight as possible.

A brushless electrical motor is preferred where the powered device is to be a radio as a brushless motor does not introduce interference.

In an embodiment, said gear means comprises a series of interengaging gears arranged to rotate said rotor at a higher speed of rotation than that of said torque drum.

The gear means is designed to gear up the speed of rotation of the rotor to an appropriate speed. For example, if the motor is arranged to generate a six volt voltage at a rotation speed of 1000rpm the gear means would be arranged to rotate said rotor at a speed of the order of 1000rpm.

The gear means may be constructed in any appropriate manner. Preferably, the gear means comprises a series of interengaging gear wheels. The gear means should be arranged to have a low friction and it is also preferred that the gear means is lightweight. In a preferred embodiment, the gear wheels of the gear means are made of plastics material.

The provision of voltage regulator means at the output terminals of the electrical motor is important in enabling

satisfactory operation of an electrical device. What is more, if power is not being taken by the electrical device momentarily, for example, where a radio goes off station, the voltage regulator means, in limiting the output, preserves the mechanical potential energy stored by the spring motor. That is, a large dissipation of energy is avoided in such circumstances.

Any suitable voltage regulator means may be provided. However, for simplicity, it is generally preferred that a Zener diode circuit, or a single Zener diode, be electrically coupled to one of the electrical output terminals.

Electrical storage means, such as an electrical capacitor, is also preferably coupled to the electrical output terminals. Such storage means act in a smoothing capacity to ensure a substantially constant output. Furthermore, the storage means may provide an output when, momentarily, there is no generation of power, for example because the spring of the spring motor has unwound. In this circumstance, the capacitor may enable the spring motor of the generator to be wound up again without any interruption of supply during the wind up process.

In an embodiment, electrical connection means, such as a jack plug, are electrically coupled to the electrical output terminals. Thus, the electrical device, such as a radio, may be powered simply by plugging the jack plug into a power socket of the radio.

A specific embodiment of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawing which shows one embodiment of an electrical generator of the invention.

In parts of Africa, whilst electrical radios are widespread, there is no mains electricity supply. Therefore, the radios are battery powered. However, the batteries themselves are not always easily available, and even if they are, are generally very expensive compared with the local cost of living. For this reason, the owners generally operate their radios only infrequently so that they can save and conserve battery power. This is a disadvantage in a region where it would be advisable and advantageous if information could be made available much more readily to the local people.

The present invention proposes a portable electrical radio which can be powered simply by winding it up, as was the case with clockwork clocks and watches. This means that no batteries have to be obtained. As soon as any degradation of the performance of the radio indicates that the power is failing, it is only necessary to wind up the radio again.

The wind up radio, which does not require batteries, is also environmentally and economically advantageous, particularly in rural, poor communities. Presently, many poor economies spend a disproportionately large proportion of their resources on acquiring batteries for electrical devices. Where the financial resources are not available, minerals may be mined or other natural resources utilised to fund the acquisition with consequent disadvantage to the present and future economy, and land which might have been utilised for agriculture becomes unavailable. Furthermore, there is a problem of disposal of the spent batteries which contaminate the land if they are buried. All of these ecological problems are avoided by the use of wind up radios.

The portable electrical radio is substantially

conventional and has normal electrical circuits to enable it to perform its functions. Thus, the electrical circuits will comprise tuning and amplifier circuits, and loudspeaker drivers, for example. Power is fed to these circuits by way of the electrical generator which is connected to the radio by way of a jack plug (not shown) connected to power output lines 2.

The generator illustrated comprises a spring motor generally indicated at 4. The spring motor comprises a storage drum 6 which is mounted to be freely rotatable and a torque drum 8 which is rotatable together with a torque output shaft 10. A tensioned steel band spring 12 has one end fixed to the storage drum 6 and the other end fixed to the torque drum 8. In its unstressed position, the spring 12 is wound around the storage drum. If the torque drum 8 is wound, for example, by way of a wind up key 18, in the direction of the arrow A, the spring 12 is wound from the storage drum 6 onto the torque drum 8. This wind up process is arranged to stress the spring 12 such that mechanical potential energy is stored in the wound spring 12 on the torque drum 8. The energy stored, and the torque subsequently delivered, is dependent upon the spacing between the axes of the two drums 6 and 8, which axes are arranged to extend substantially parallel, upon the relative diameters of the two drums 6 and 8 and upon the width and thickness of the material of the spring 12. Such spring motors and the springs therefor are commercially available, the springs generally being referred to as "Tensator™" springs.

When the spring 12 has been wound onto the torque drum 8, it tries to unwind to release the stress to which it has been subjected, and in doing so rotates the torque drum 8 and the torque output shaft 10. The torque output shaft 10 is connected by a series of gears, indicated at 14, to an

electrical motor 16. The gear means 14 comprises a plurality of plastics material gear wheels which are intermeshed and which are arranged to gear up the rotation of the torque output shaft 10. For example, the gear means 14 may be arranged to rotate the rotor of the motor 16 at a speed of the order of 1000rpm. The motor 16 is preferably a compact brushless, internal rotor construction and is arranged to deliver a substantially constant voltage, for example, of six volts when its rotor is rotated at a constant speed of substantially 1000rpm.

The motor 16 has two electrical output terminals 20 which are connected to the power output lines 2. In the positive supply line, a Zener diode 24 is provided to limit the maximum output voltage. Thus, if the electrical power is feeding no load, for example, because the radio has gone off station, the Zener diode 24 acts to conserve the mechanical power. A capacitor 22, of relatively large capacity, is preferably connected across the negative line 2. During normal power supplying operations the capacitor 22 has the effect of smoothing the voltage output. The capacitor 22 also stores electrical power so that the radio may be kept operational during a wind up process.

The use of voltage regulator means, rather than a mechanical government, to control the output is extremely important. If a mechanical governor were employed, for example, to ensure rotation of the rotor at a substantially constant speed, the resultant generator would have a constant voltage output set at the particular voltage determined by the governor. The generator would then only be capable of powering an appropriately rated device. By contrast, electrical voltage regulator means can enable the generator to provide a voltage output at one of a range of voltages as required.

In the embodiment illustrated, the voltage regulator means comprises the Zener diode 24. The output voltage may therefore be selected by selection of an appropriately rated Zener diode. In an alternative embodiment, not illustrated, a Zener diode circuit may be provided incorporating a number of differently rated Zener diodes and switch means operable to switch selected ones or combinations of the Zener diodes into the voltage output circuit. In this manner, the generator may be made comparable with, and thus able to power, a range of electrical devices.

The arrangement shown in the Figure is capable of providing power to operate a transistor radio for the order of one hour. It is then only necessary to re-wind the spring 12 onto the torque drum 8 to continue the radio operation.

Because the generator shown in the Figure is a stand alone device, employing the jack plug to make the electrical connection to the radio, it may also be used for other applications where electrical power is required.

In some poor countries, jack plugs and other connectors may not be available. Of course, the electrical connections may then be made by connecting the output lines 2 directly to the radio, and appropriately holding them in place.

The generator illustrated may alternatively be made sufficiently compact that it may be incorporated into the radio, for example in the space traditionally provided for batteries.

Of course, it will be appreciated that variations and modifications to the invention as described above may be

made. The mechanical energy for operating the radio may be generated and stored in any appropriate manner. Similarly, the electrical device powered by the stored mechanical energy may be a device other than a radio.

Whilst the invention has been developed specifically with the problems of Third World regions in mind, it also has other applications. For example, travellers may find it more convenient to carry mechanically powered electrical devices on their travels so that they are not let down if the battery runs out. Travellers will not then have to carry spare batteries or to try to find compatible replacements in a foreign country.

The invention is also particularly useful for emergency applications where an electrical device is not used frequently but must be available for use reliably. For example, if a battery powered radio and/or transmitter is provided in a liferaft or lifeboat it is currently necessary to check the batteries frequency to ensure power is available as and when required. A wind up device has the advantage that, once it has been wound up, it reliably provides power.

It will be appreciated that other modifications and improvements to the invention may be made within the scope of this application.

CLAIMS

1. An electrical generator for powering an electrical device, said electrical generator comprising a spring motor having a metal band spring arranged to be stressed by being wound onto a rotatable torque drum and arranged to unwind from said drum to cause rotation thereof, an electrical motor having a rotor arranged to be rotated by the rotation of said torque drum and to thereby generate an electrical supply voltage at output terminals of said motor, gear means for coupling said torque drum to said rotor and arranged, upon the rotation of said drum, to rotate said rotor at a predetermined speed of rotation, and voltage regulator means electrically coupled to the output terminals of said motor such that the rotation of said torque drum causes a substantially constant voltage output.

2. An electrical generator as claimed in Claim 1, wherein said spring motor has a metal band spring arranged to deliver a substantially constant force and thereby to cause said torque drum to rotate at a substantially constant speed of rotation.

3. An electrical generator as claimed in Claim 1 or Claim 2, wherein said metal band spring is a prestressed band of steel.

4. An electrical generator as claimed in any preceding claim, wherein said spring motor comprises a freely rotatable, storage drum arranged such that the axes of said torque and storage drums extend substantially parallel, and wherein each end of the metal band spring is fastened to a respective one of the torque and storage drums such that the metal band spring may be wound from one of the drums onto the other.

5. An electrical generator as claimed in any preceding claim, further comprising a wind up key arranged to rotate said torque drum in a direction to wind said metal band spring onto said torque drum.

6. An electrical generator as claimed in any preceding claim, wherein said electrical motor is a compact, lightweight, brushless, electrical motor.

7. An electrical generator as claimed in any preceding claim, wherein said gear means comprises a series of interengaging gears arranged to rotate said rotor at a higher speed of rotation than that of said torque drum.

8. An electrical generator as claimed in Claim 7, wherein said gear means is arranged to rotate said rotor at a speed of the order of 1000rpm.

9. An electrical generator as claimed in Claim 7 or 8, wherein said gear means comprise a series of interengaging gear wheels.

10. An electrical generator as claimed in any of Claims 7 to 9, wherein said gear means are made of a plastics material.

11. An electrical generator as claimed in any preceding claim, wherein said voltage regulator means comprises a Zener diode electrically coupled to one of said electrical output terminals.

12. An electrical generator as claimed in any preceding claim, further comprising electrical storage means coupled to said electrical output terminals.

13. An electrical generator as claimed in Claim 12,

wherein said electrical storage means comprises a capacitor.

14. An electrical generator as claimed in any preceding claim, further comprising electrical connection means electrically coupled to said electrical output terminals.

15. An electrical device comprising electrical circuit means for performing the functions of said electrical device, and an electrical generator as claimed in any preceding claim coupled to supply electrical power to said electrical circuit.

16. An electrical generator substantially as hereinbefore described with reference to the accompanying drawing.

17. An electrical device substantially as hereinbefore described with reference to the accompanying drawing.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

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Relevant Technical fields

(i) UK Cl (Edition L) F2S (S22A, S22B); H2H (HBCB, HBCH, HAF, HAJ)

(ii) Int Cl (Edition 5) H02K, H02J

Search Examiner

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Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

25 FEBRUARY 1993

Documents considered relevant following a search in respect of claims 1

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 1432900	(SOLID) - Note figure	1 at least
Y	GB 1282967	(SOLID) - Note eg Figure 8	1 at least
Y	GB 0217492	(MOTTURA) - Note Figure 3	1 at least
Y	DE 3442862 A1	(MIGOWSKI) - Note Figure 1	1 at least
Y	GB 1180168	(GEC) - Note example of voltage regulator 31 in Figure 3	1 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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